IPTV Concepts related to Kosovo's Telecommunication Network

SHKELZEN CAKAJ, VEHBI SHEHOLLI, HYSEN GASHI
Post and Telecommunication of Kosovo (PTK),
Dardania, nn., 10000 Prishtina,
KOSOVO
E-mail: *Shkelzen.cakaj@ptkonline.com: shkelzencakaj@yahoo.com*

Abstract: - PTK (Post and Telecommunication of Kosovo) is incumbent telecommunication operator, still as a public owned company providing fixed, mobile and internet services in Kosovo. Mobile operator has around 850.000 customers. On the fixed side is not done too much on penetration increment (currently is around 6%), but very good steps on technological level are taken. The complete network structure is digitalized, based on TDM and NGN concept. Both these structures today are operational providing services for voice and data through ADSL fixed lines. The transmission infrastructure is based on MW and F.O, always aiming toward building the strong fiber optic based structure. Although the main optical fiber back bone is still under implementation, the existing operational switching and routing infrastructure of main centers of Kosovo are interconnected to transmission structure on SDH hierarchy or on dark fiber concept through gigabit Ethernet level. Through this paper the future aspects of network development toward IPTV implementation in Kosovo's network are presented.

Key-Words: - Network, IPTV, video- on -demand

1 Introduction

Every day needs of telecommunication services are related to bandwidth requirements. Despite very large developments in mobile technology, fixed network solutions are providing larger bandwidth and probably will continue to offer in the near future, also. The bandwidth available to the fixed network end-users is limited by the length and quality of the local loop. Problems encountered by DSL (Digital Subscriber Line) technology when using copper cable will be solved by fiber optic NGA (Next Generation Access) topologies and technologies. Although it is difficult to make predictions about the future applications, it is to believe that the TV content will be on the high level demands in the next coming years [1]. IPTV as a new product, either through copper or fiber, should open the door to the new revenues for fixed operators attracting more customers. The approach on IPTV implementation in Kosovo's telecommunication network within these papers is presented.

2 IPTV Concepts

Network configuration which enables transport of voice and data through DSL (Digital Subscriber Line) technology to the customer premises today is largely deployed. These services nowadays are provided also in Kosovo's network through xDSL technologies, supported by IP/Ethernet optical core network and IP based switching/routing infrastructure. One of the most mentioned concepts for video transport over the high-speed wireline and wireless broadband networks is known as IPTV, in other words meaning, the delivering of video content over a converged IP network. Customer's video content accessibility is enabled through the CPE (Customer Premises Equipment). CPE has broadband network termination functionality. IPTV via broadband offers potential access to almost very large volume of content compared with traditonal distribution capacities for television content. The content itself may be standard or high definition. IPTV content can be provided through *video on demand library, broadcast terrestrial service* and *satellite access.* IPTV service implementation reflects necessity of network architecture transformation toward IP technology and Ethernet transport platform. PTK, as telecommunication service provider in Kosovo, has done a large step forward on this transformation by implementation of next generation network IP MPLS (Multi Protocol Label Switching) based, from the edge to the core level. The future steps are oriented on end - to - end Ethernet transmission network transformation. IPTV has been launched by major service providers worldwide and its popularity with consumers is on the rise. Generally, there are four development stages for IPTV, as further described.

2.1 Video - on – Demand

Video on demand services are similar with DVD type of video services. The main difference is that the content is stored to service (content) provider to whom the user has access through respective network [2]. The end user decides when to watch, with full control over how content is played: pause, slow motion, fast forward, rewind etc. For video-on-demand services, the normal DSL bandwidth should be sufficient. But, necessary investments for video-on-demand servers are needed. The problem of in-house networking should be considered, also.

2.2 TV channels deliver

The next IPTV function is to deliver to customers the existing broadcast TV channels through IPTV platform. Broadcast TV services include the traditional analog channels, digital terrestrial television channels and those offered by coax cable or satellite platform. This function is a deeper challenge for broadband networks with impacts related to both, the core network and the last mile. Since broadband capacity is limited and falls with distance, last mile bandwidth it is not enough to accommodate all channels to be delivered at the same time. Thus, quality of services becomes essential, especially at the evening services when most users watch TV and will not tolerate bugs [2]. For HDTV criterions are even more serious. Commercial offerings may consist of channel packages. Each package is sold individually and usually charged on a monthly fee per package basis.

2.3 Interactive IPTV

IPTV consumers have a new opportunity, from passive television consumption to activate the downloading of the desired content. But, further stage of IPTV service is the opportunity of interactive process of consumers related to the content provided through such a service. As a result of interactive possibilities, this phase offers the potential for a complete turnaround in consumer behavior with the new opportunities related to content and services. Some of these opportunities are: Instant channel change with minimum interruption, Time shifted television, One touch recording, PIP- picture in picture, Time based recording, Customization per category, etc [2]

2.4 Self generated content

Content digitalization and the interactive opportunities offered by IPTV services, enable digital video services to be tailored of individual users, known as *self generated content*. Since costs of global network distribution are decreasing, and production cost of content generation (records with simple digital camera) are being reduced dramatically, the self content generation feature represents significant added value for users themselves. This feature in one hand will increase the customers' willingness to spend time with such a service and on other hand consequently will impact on higher market revenue [2]. This is a new era on creating TV channels for individual persons, families and companies delivered through telecoms' networks. Interactive advertising could also become a reality. Based on the above development stages of IPTV, the main advantages of IPTV service, compared with traditional terrestrial, cable and satellite access are listed below.

- On -demand accessibility
- Interactivity (Interoperability)
- Self generated content

3 Network Topology

The readiness of already implemented NGN platform in Kosovo's telecommunication network and steps which should be taken related to IPTV implementation are further described in this section.
PTK network is based on centralized service platform and distributed access. The system is organized in 7 regions, in each region there is a traffic aggregator ESS (Ethernet Service Switch). Further traffic from these 7 ESS is aggregated to the Core Router [3]. Network design is based on 4 main network concepts:

- Access Network
- Edge/Core Network
- Transmission Network
- Service Platform

3.1 Access network

The access network consists of:

Multi-service access nodes - able to deliver different services including: telephony, data, High Speed Internet Access and Video services, where the same copper pair is used for various mix of services. Currently in PTK it is a case of POTS and ADSL services.
DSLAM - (Digital Subscriber Line Access Multiplexer). Within PTK network this type of equipment are used exclusively to offer high speed internet access through ADSL in urban areas [3].

3.2 Edge/Core network

Edge/Core network build in PTK uses label switching technology MPLS (MultiProtocol Label Switching) which provides the ability to set up connection-oriented paths over a connectionless IP network. There are seven ESS installed, one per region. All access nodes from the region are connected to regional ESS. ESS is handling intraregional traffic received from end customers through access nodes (Litespans and DSLAMs) as presented in Fig. 1.

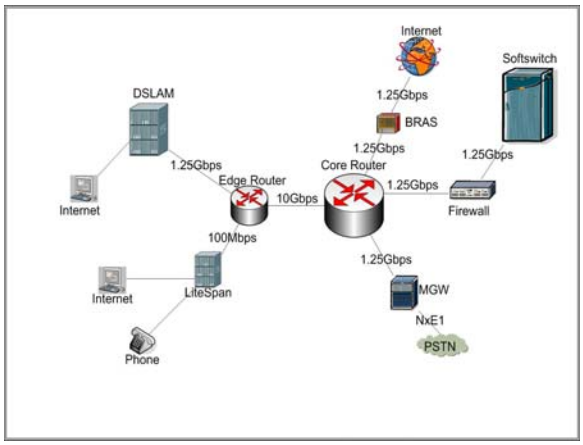

Fig. 1. System configuration

Further, all regional ESS are connected to the Service (Core) Router, as presented in system configuration through Fig. 1.

Edge/Core network include:

Ethernet Service Switch (ESS) is the edge component of the network able to offer the following types of services: Ethernet pipe (Epipe) Frame-Relay (Fpipe), Virtual Private LAN Service (VPLS), Internet Enhanced Service (IES).

Service Router (SR) – is the core router able to offer the following services: Ethernet pipe (Epipe), ATM VLL (Apipe), Frame-Relay (Fpipe), Virtual Private LAN Service VPLS, Internet Enhanced Service (IES), Virtual Private Routed Network (VPRN).

Since already implemented NGN structure is VoIP – MPLS, the remote access nodes had to be interconnected on Ethernet platform. This is achieved by three methods. First, through fiber optic equipment using Ethernet interface, second, by dark fiber and media converter, and as a third one where we had no fiber access are used MW equipment with E1/Ethernet converters.

3.3 Transmission network

The existing transmission network in PTK is build of two systems Micro-Wave (MW) and optical fiber (OF) configured in meshed topology. MW is used where there is no fiber optic access or as a redundancy. For transmission through fiber the SDH-OMSN (Optical Multi–Service Nodes) equipment are used. By OMSN equipment can be provided capacities like:E1, E3, STM-n, Ethernet, Fast Ethernet, Gigabit Ethernet, VLANwith QoS managed. This structure enables interconnection of remote access nodes for both, voice and data services. By 2008 the interconnection of all edge routers to the core router will be completely fiber optic based with capacities of 10Gb/s as it is presented in the Fig. 2 [4].

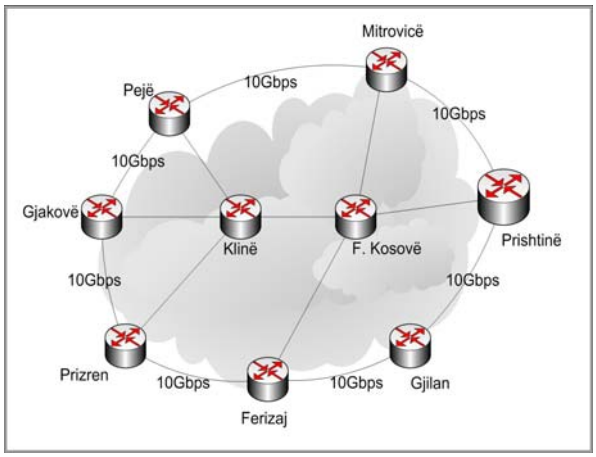

Fig. 2. Edge/core transmission network structure

So, regional systems in: Mitrovice, Peje, Gjakove, Prizren, Ferizaj and Gjilan are accumulating traffic from all nodes using MW and OF. These centers will be interlinked to the main center in Prishtina through 10Gb/s. There are two other centers, Kline and F.Kosove established as optical node centers for access of lower level municipalities.

3.4 Service platform

There are two concepts building service platform:

Narrowband services are phone services offered by SoftSwitch and supplementary services offered by IN such as Centrex, Prepaid, Televoting etc.

Broadband Services are data services offered by broadband platform Routers, BRAS (Broadband Remote Access Server) and Radius server (see Fig 1). So far PTK is offering Internet and Virtual Private Networks (VPN). In near future PTK aims to offer IPTV services.

4 IPTV Implementation in Kosovo

PTK, as Kosovo's telecommunication service provider plans to offer bundled services, including video services (as IPTV) and various combinations of voice and data services. These bundled services, often called the '*triple play*,' will provide to the customers greater value and more convenience. Delivering triple play services creates a number of demands on the network beyond the traditional requirements for voice and Internet access. Video in particular has a significant impact. Bandwidth must increase in order to accommodate video content. Standard definition TV stream requires about 3Mb/s bandwidth, but with high definition standard bandwidth increases to at least 8 Mb/s per stream. Video streaming requires constant bandwidth. If bandwidth is reduced the picture pixelizes. This result in high bandwidth reflects both at the customer access connection and on the complete network [1]. The implementation aspects of IPTV services in Kosovo's telecommunication network are four itemized:

- Upgrade of existing VoIP – MPLS platform
- Local loop upgrade and NGA implementation
- Home networking
- Content acquiring

IPTV service for Kosovo's network is low-margin business case due to: not large number of customers is expected, high cost of set–top box and the expenses of acquiring content.

4.1 Platform upgrade

The elements that are involved in the IPTV service are the DSLAMs, the Ethernet network, the BRAS, the video servers, both on demand and broadcasters, the firewalls and management servers of the network elements and the CPEs. [5]. From this perspective, for already NGN IP-MPLS platform implemented in Kosovo network, further investment have to be oriented on both, broadcast and on–demand servers. By implementing these servers the network shown in Fig. 1, will be transformed as in Fig. 3. The architecture concept is based on video-on –demand server per each region connected to the respective edge router. By this concept, traffic will be kept as regional and main links to the core router will not be congested. Then, the broadcast server is planned to be connected to the core router, where all customers will have access through respective edge routers. In case the user selects to access the video service, user will be required to login using a username and password combination. The subscriber username and password will be forwarded by BRAS to the radius server. Based on these supplied credentials the radius will either deny or accept the service request and assign to the subscriber's CPE an IP address. In case the service is allowed to the user, for the on –demand service the user is oriented to VoD server located at the region where user belongs. If the user selects to see a real time content, then he is redirected to the broadcast video server interlinked to the core router, from where all clients receive live streams using IP multicast.

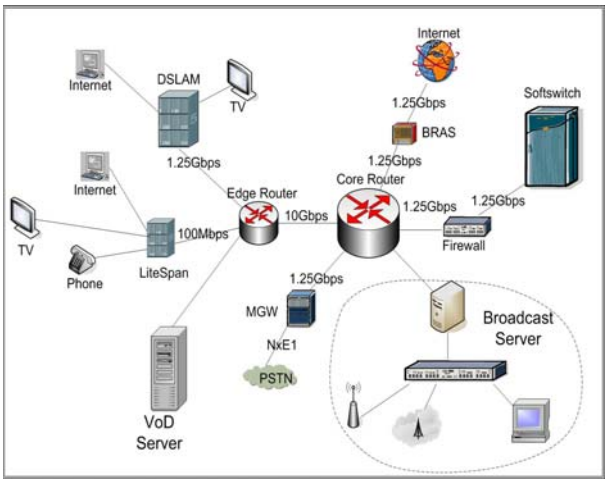

Fig. 3. Network upgrade with video servers

4.2 Local loop upgrade and NGA implementation

Video services are very sensitive. QoS is additional concern for IPTV service delivery. ITPV QoS is expressed through two components: the first one is the video quality referred to the video content itself which is more concern of video content provider, and the second one refers to how video content is delivered from the operators facilities over broadband to the customer premises. Here the local loop represents the main problem, considering the line stability, since the delay or loss of video packets may degrade the quality of these services to unacceptable levels [6].

Local loop average length in Kosovo network is around 2km, so up to 5Mb/s is available through ADSL2+ what supports triple play with standard TV definition. But, these lengths vary depend on the area, so the maximal length ranges up to 5km. These lead to further development concepts of local loop in Kosovo, considering below stages:

• *New PoPs by DSLAMs implementation*
By this approach the distance between customer's premises and point of presence will be shortened on the length less than 1km, thus by ADSL2+ through NGN platform the IPTV could be provided.

• *Fiber optic access nodes*
The magic number for the bandwidth of a successful IPTV service offering is generally accepted to be in the range of 20Mb/s. Delivery of 20Mb/s or more to all subscribers requires fiber access network. In general, fiber to the node (FTTN) and fiber to the building (FTTB) combined with very high speed digital subscriber line (VDSL) allowing for the reuse of existing copper pairs are more cost – effective in brownfield deployments and allow faster time to market, while fiber to the home (FTTH) is more cost effective in greenfield situations. Fiber to the node requires an IP digital subscriber line access multiplexer (DSLAM) to be housed in a street cabinet. Connections to the customers will be VDSL2/ ADSL2plus. Fiber to the building, a small DSLAM will be placed in the basement of building and will connect to individual apartments using VDSL2/ ADSL2plus. By applying the concept of fiber to the node (building) we will be ready to provide a HDTV for Kosovo's customers. Fiber optic backbone already implemented creates the environment for fiber access nodes implementation.

• *Wireless access technologies*
Delivering broadband service to premises is always the most difficult part and hugely expensive. Wireless broadband access technologies include wireless Local Area Networks (LANs), cellular systems and respective technologies. The Wi-Fi (Wireless Fidelity) standards 802.11b or 802.11g were designed to be used over short range and mostly indoor so they cannot solve all the problems associated with long range fixed radio access. WiMAX (Worldwide interoperability of Microwave Access) is a solution to the problem of last mile in delivering DSL or cable modem services. WiMAX is based on wireless standards developed for new radio techniques that offer long range high data rate services to residential, business and eventually to mobile users. All above mentioned activities should be taken with no significant impact on legacy services.

4.3 Home networking
For customers' home/premises networking are applicable four basic options which must be supported by access infrastructure.

• *Wired networks*
Wired networks have been utilized within the home/office environment for some time and as a result offer reliability when compared to some of other newer technologies. For new constructions, wired technology provides an extremely efficient, reliable, high-speed alternative.
• *Telephone line networks*
Phone lines provide a cleaner and more reliable medium than any other home networking technology on the market. However, this networking option is severely limited by the number of phone jacks available throughout the homes.
• *Power line networks*
Power line technology utilizes a home's existing electrical wiring to offer limitless connections allowing any electrical outlet throughout the house to be a networking location.
• *Wireless networking*
Wireless technology is untethered and offers freedom from wire-based systems allowing connections anywhere throughout the house without the need for wires or plugs in walls. Ultra wide band technologies are competing for this space.

These options, either separately or combined are going to be implemented in Kosovo's network in order to provide broadband services.

4.4 Content acquiring
Content acquiring is related to both, video on demand and broadcast delivery. For video on demand PTK will attempt to establish own video library and the broadcast delivery will be provided on contractual basis with terrestrial and satellite content providers.

8 Conclusions
Offering video over fixed access network poses radically new challenges compared to high-speed Internet. Video transport affects the network in multiple domains, including network architecture, access technology and the at home device. Kosovo's core network is already prepared for IPTV implementation. Local loop is partly ready to support these services. Considering the future bandwidth demands, PTK should transform also the last mile of the network according to bandwidth demands and trends. Upgrades in home networking have to be considered, also. The long term orientation is building flexible and intelligent optical networks which will support so called "hungry bandwidth services".

References:

[1] Cullen International 2007, Telecommunications EU level, Flash Message 102/2007, ERG opinion on next generation access (NGA), Oct 2007.

www.cullen-international.com

[2] S. Borscheid, A. Hopkinson, Th. Langer, Pan Europian Equity Report, Broadband networks of the future – Who actually needs 100Mb/s ?, WestLB AG, London Branch, August 2007, pp. 29-36.

[3] Sh. Cakaj, M.Shefkiu, "Migration from PSTN to NGN", *49th International Symposium, ELMAR - 2007*, IEEE, Zadar, Croatia, Sept. 2007, pp.183-186.

[4] Sh. Cakaj, H. Gashi, M.Shefkiu, "Topology aspects of FTTH implementation in Kosovo's telecommunication network", *50th International Symposium, ELMAR-2008*, IEEE, Zadar, Croatia, Sept. 2008, pp.577-580.

[5] T. Wauters, IPTV Deployement: Trigger for advanced network services, 45th FITCE Congress, 30 August - 2 September 2006, Athens, Greece, pp. 36-40.

[6] S. Vanhastel, R, Hernandez, Enabling IPTV-Breaking the Barriers, Alcatel – Lucent, Canada 2008, pp. 203-213.